

551.577.37

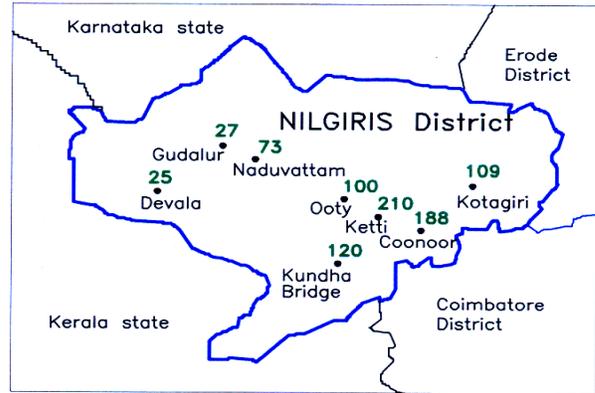
RECORD RAINFALL OVER KETTY VALLEY, NILGIRI, TAMIL NADU

1. In the recent years, floods in one part of country and drought in other parts of country is not uncommon in India. Extreme weather events like continuous very heavy rain and floods caused heavy loss of lives and property, damage of roads, banks of rivers in urban and rural areas. Extremely very heavy rainfall over a small areas in the hilly regions make misery in the life of hilly region people due to land slides, soil erosion across roads, rail lines, damage of crops and heavy loss of human lives. The recent extreme very very heavy rainfall over Ketty Valley in Nilgiri district in Tamil Nadu made havoc over the area damaging hundreds of houses and death of more than 40 human life. Ketty, located at a height of about 2100 m above mean sea level in Nilgiri (11° 22" 01' N & 76° 44" 32' E) is a valley surrounded by hills in three directions and opening only in the ESE direction. It recorded the heaviest rainfall of 820.0 mm in 24 hrs ending 0830 hrs IST on 10 November 2009. In this paper reasons of extreme record rainfall at Ketty in Nilgiri hills and its impacts have been analysed.

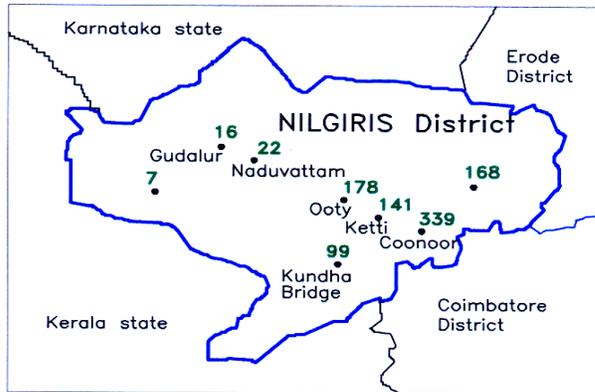
2. Orographic configuration of an area adds to the vertical lifting necessary for the formation of Cb clouds and the torrential downpour of rain of high intensity from Cb clouds leads flash floods, land slides in hilly region. Cloud burst defines torrential down pour of rain of high intensity literally suggesting the bursting and discharge of water from a cloud at once (AMR 2010 report). Sudden cloud burst in hilly areas of Himachal Pradesh caused heavy rainfall over a small area which leads to land slides during SW monsoon season (Bhan *et al.*, 2004 and Kulandaivelu, 1996). The record rainfall of 944 mm on 26 July 2005 in 24 hrs recorded at Colaba in Mumbai (Kumar *et al.*, 2007) attributed due to impact of low level jet during SW monsoon season.

3. Tamil Nadu the southeastern parts of peninsular India receives more than 40% of its annual rainfall during NE monsoon season and less rainfall during SW monsoon season. However, Nilgiri, the hilly region of Tamil Nadu being the part of Western Ghats generally receives more rainfall during SW monsoon than during NE monsoon. On many occasions whenever a synoptic system cross Tamil Nadu coast and move inside the land area the interior Tamil Nadu including hilly areas of Nilgiri district receives copious rainfall with isolated extremely very heavy rain in the district (Source : Climatology Section, IMD, Chennai). Before 10th November 2009 the heaviest rainfall in 24 hrs recorded in Nilgiri district was 448.3 mm at Kodanad on 15th Nov, 1992. Some of the Storms and

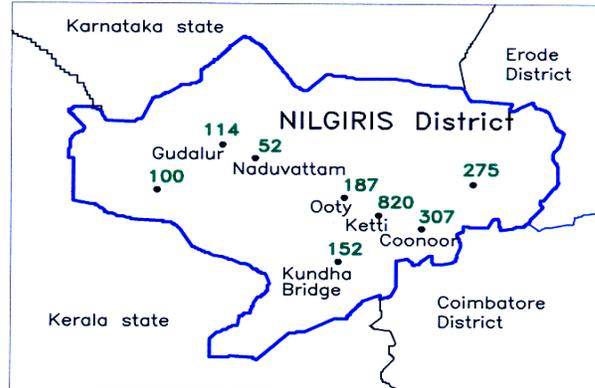
(a) Rainfall (mm) on 8 November 2009



(b) Rainfall (mm) on 9 November 2009



(c) Rainfall (mm) on 10 November 2009



Figs. 1(a-c). Distribution of rainfall in Nilgiris district during 08 – 10 November 2009

Depressions which form in the Bay of Bengal during November and December affect the weather over the Nilgiri district causing heavy rain (Climate of Tamil Nadu, 1999, India Met. Dept., Pune).

Table 1 shows the list of heaviest rainfall more than 40 cm occurred in Tamil Nadu. Except few occasions

TABLE 1
List of heaviest rainfall (more than 40 cms in 24 hrs) in Tamil Nadu

S. No.	Station Name	Amount of rainfall (mm)	Date of record rainfall
1.	Papanasam (Tanjavur Dist)	480.1	07 th Nov, 1917
2.	Cuddalore	572.0	18 th May, 1943
3.	Aanamalai (Coimbatore Dist)	515.6	20 th Nov, 1959
4.	Nagapattinam	432.6	05 th Dec, 1963
5.	Vandavasi (Thiruvannamalai Dist)	709.0	05 th Aug, 1965
6.	Mahabalipuram	539.6	20 th Nov, 1970
7.	Chennai(City) Nungambakkam	448.0	25 th Nov, 1976
8.	Palaviduthi (Tiruchirapalli Dist)	500.0	31 st Oct, 1981
9.	Karaikal	480.9	15 th Nov, 1991
10.	Kodanad	448.3	15 th Nov, 1992
11.	Vedaranyam	418.4	27 th Nov, 2008
12.	Ketty (Nilgiri Dist)	820.0	10 th Nov, 2009

(Source : Climatology Section, RMC, Chennai)

most of the heaviest rainfall has been occurred during NE monsoon season. As for Nilgiri district, Kodanad is the second heaviest rainfall recorded station after Ketty which recorded 82 cm rainfall in 24 hrs on 24th November 2009.

4. The rainfall recorded by various stations in Nilgiri district on 8th, 9th and 10th Nov, 2009 is shown in Figs. 1 (a-c). Coonoor which is close to Ketty recorded extremely very heavy rainfall of 34 cm and 31 cm on 9th & 10th Nov, 2009 respectively, whereas Ketty recorded very heavy rainfall of 21 cm on 8th, 14 cm on 9th and the record rainfall of 82 cm on 10th Nov, 2009 in 24 hrs. Another station Kothagiri which is slightly lower elevation than Ketty and Coonoor recorded very heavy rainfall of 17 cm on 9th and extremely heavy rainfall of 27 cm on 10th. Ootacamund (Ooty) which is higher than 2000 m a.s.l. and west of Ketty also experienced very heavy rainfall of 18 cm and 19 cm on 9th and 10th Nov 2009 respectively.

A low pressure formed over Comorin area on 07 November 2009 and became a well marked low on 08th. The Comorin area and adjoining Arabian Sea became Depression on 9th, moved towards north and intensified as deep depression on 10th November 2009. Under its influence, heavy to very heavy rainfall occurred in west interior and coastal Tamil Nadu. The Ketty valley which has the average elevation of 2000 m a.s.l. is surrounded by

hills except east-southeast side situated in west interior parts of Tamil Nadu. It received extremely heavy rainfall on 10th Nov 2009. The valley faces windward side for NE monsoon and leeward side for SW monsoon. The presence of a depression in Arabian sea (Lat. 11.5° N, Long. 71.5° E at 1200 UTC) on 9th Nov 2009, about 450 km west of Mangalore, influenced the easterlies from Bay of Bengal. The moist air mass entered inland through the land mass of Tamil Nadu. As the depression moved initially in the northerly direction, the strong low level easterly wind mass between Lat. 11 and Lat. 12 deg N rushed towards the centre of the depression/deep depression in Arabian sea through the landmass of Tamil Nadu. The winds from the Bay of Bengal entered into Ketty Valley from south to southeasterly direction and were forced for ascend by the orography. This elevated ascent of moist air triggered the formation of mesoscale vortex over the valley and rained there heavily. Nilgiri Mountains trapped the moisture of easterly wind which condensed into raindrops. Lifting of the unstable moist air by the process of convection lead to cooling and condensation of moisture lead to heavy downpour over the Ketty valley during day and night on 9th as well as early morning hours on 10th. The state revenue officials recorded the rainfall at Ketty, near Ketty railway station, measured good number of rain spells throughout the day and night to avoid overflow of rain water from the rain gauge jar on 9th & 10th of November 2009.

5. The occurrence of heavy to extremely heavy rain successively on 8th & 9th in Nilgiri hills made the soil wet and loose and it could not have the capability to hold the additional rain in the soil. The exceptionally heavy down pour/heavy shower on the evening/night of 9th and early morning of 10th over the hills played crucial role for land slides in large number of places in the district. Especially the record rainfall of 82 cm in 24 hours caused more than 30 land slides in and around Ketty station and loss of 42 human lives. Many crores of properties, crops and cattles have been lost due to heavy rain and land slides. Also a large number of houses have been damaged.

This record rainfall also made another highest record of 2.56 lacs cubic feet of water reached per minute on 10 Nov, 2009 since construction of the Bhavani Sagar Dam as per PWD, Tamil Nadu which enhanced the water level of the dam raised 8 feet height in a single day.

References

- AMR 2010, Report by Office of Deputy Director General of Meteorology (Weather Forecasting), India Meteorological Department, Pune. 130-131.
- Bhan, S. C., Paul, Surender and Kharbanda, K. L., 2004, "Cloud burst in Himachal Pradesh", *Mausam*, **55**, 4, 712-713.
- Climate of Tamil Nadu, 1999, Monogram, India Meteorological Department, Pune.
- Kulandaivelu, E., 1996, "Glacier Expedition- an experience" - *Vayu Mandal*, **26**, 3-4, 85-88.
- Kumar, Vinod, Bhagat, D. K. U. R., Satya Kumar, M. and Ganesh, Shiv, 2007, "Impact of Low Level Jet on heavy rainfall events over Mumbai", *Mausam*, **58**, 2, 229-240.

E. KULANDAIVELU
M. V. GUHAN

Regional Meteorological Centre Chennai, India
(Received 22 April 2010, Modified 22 June 2010)
e mail : metmds@snl.com
